Mainports and Gateways in Europe - a Comparative Contrast Analysis of Dutch and Finnish Cases

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1998

Faculty of Economics, Business Administration and Econometrics

SERIE RESEARCH MEMORANDA

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Research Memorandum 1998-20

vrije **Universiteit** *amsterdam*

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ABSTRACT

This paper addresses the design of an evaluation methodology for mainports and gateways as strategic nodal and multi-modal centres in an international transport network.

After an exposition of the concepts of mainports and gateways, the attention will be focussed on the critical relevance of mainports and gateways for two distinct countries, viz. the Netherlands and Finland. The difference between the transport networks of these two countries -seen from a European perspective- will be highlighted. The Netherlands has two principal mainports, viz. Rotterdam harbour and Schiphol airport, while Finland has two gateways, viz. the Barents region and the Baltic region. Clearly, the transport-economic functions of these areas are different, depending on socio-economic, geographical and logistic differences between both countries. Therefore, a contrast analysis for a comparative strength-weakness investigation of these areas will be undertaken.

This contrast analysis will be based on the Pentagon model encapsulating five critical (key) conditions for the attractiveness of these areas. The comparative contrast analysis will be based on a multicriteria analysis, in particular the so-called regime method. From the results of this analysis, policy guidelines on mainport and gateway strategies will be derived, in particular with a view on the European unification process as reflected inter alia in the Trans European Networks.

I. INTRODUCTION

Europe is moving. in a Europe without borders, everything seems to be in motion. This is certainly the case in the transport sector which plays an important role in the process of integration within Europe. in the movement towards unification, European transport networks play an important role. Europe is moving towards an integrated network economy where important nodes of economic, cultural and technological progress are linked together by a well-connected infrastructure network. The new network economy is characterised by economic integration, political coordination, regional autonomy and human mobility.

Against this background, the concept of mainportsand gateways has become a recent popular idea. The considerable growth of transport junctions has been the main reason to develop these integration concepts. Currently, the exchange of information, people, goods and services in Europe is rapidly increasing. This increase is a result of prevailing economic trends and political processes in Europe. The growth of transport in Europe puts the European transport networks under heavy stress. This contrasts with the view of others that these networks have not yet reached their maximum potential performance. One reason for this sub-optimal performance is lack of adequate policy initiatives and proper management of scarcity in networks.

In this study two European countries will be investigated and compared in terms of their gateway and mainport policy and network opportunities, viz. the Netherlands and Finland. The main similarity of these two countries is that both belong to the European Union (the Netherlands since the foundation in 1957 and Finland since 1995). Differences between these countries are easier to find than similarities. The most conspicuous differences are the size and geographical position. The Netherlands is a small country with a central position within Europe and has at its disposal two mainports. Finland, on the other hand, is geographically one of the largest countries in Europe; it has a peripheral position and has at its disposal two gateways. Although the Netherlands is much smaller than Finland, it has more than three times as many inhabitants.

The main aim of this paper is to undertake a contrast analysis of the Dutch and Finnish mainports and gateways on the basis of the so-called pentagon prism. With this analysis we try to answer the question: “What is the position of the mainports and gateways regarded by means of the pentagon prism and how can they be compared with each other?” The answer to part one of the question will be given after a thorough analysis of the concepts of mainports and gateways, by offering proper definitions for both terms and by using the critical success factors incorporated by the pentagon prism. The answer to the second part of the question will be derived from the use of Multi-Criteria Analysis (MCA). The reason for using this methodology is to provide information on the nature of conflicting interests in order to clarify to decision-makers or policy agencies the trade-offs in a complex choice situation. in the present paper a qualitative MC&variant, the so-called Regime Analysis, will be used.

2. MAINPORTS, GATEWAYS AND ECONOMIC DEVELOPMENT

2. I The **mainport** concept

In recent decades there has been an increase in the number and size of transport junctions (see Blaas et al., 1991). We take for granted here that a *mainport* is a transport junction in a certain country which takes care of the physical distribution and the related logistic activities of the incoming and outgoing international (including intercontinental) flows of commodities and people over different modes of transport from (and to) the hinterland, while it also offers related complementary services and industries.

There are two distinct mainports: airports and seaports. A major economic difference between these two types of mainports is that the value of goods transported by air is usually much higher. Tonne-wise, airports would seem to be less important, but the value of the flows by air is considerable. So in terms of value, the throughput of airports and seaports is largely comparable.

Because of its immense economic importance, a mainport must fulfil a variety of functions. The major function is the *transhipment* or transfer *function*. A mainport takes care of the supply of the transport junctions towards the hinterland. Usually this will be transhipment. Direct transhipment takes place, if cargo is directly transported from one transport system to the other. indirect transhipment is transhipment which requires temporary storage in appropriate spaces or in the open air. A mainport has a transfer function if transfer of people also takes place. A transfer from one means of transport to another is called a direct transfer, a transfer in which people stay over for short periods is called an indirect transfer. Because the transhipment via mainports takes place with the same or other modes of transport, mainports tend to develop into infrastructural junctions of several transport modes. Another function of mainports is the storage *and* distribution *function*. A widely accepted idea about mainports in Europe is that they should be central and accessible to other European cities. For this reason eminent hinterland connections are required. A third function of a mainport is the service *function*. The activities which take place as a result of transhipment, transfer, storage and distribution as mentioned above, are highly attractive to related service firms. The final function is the *industrial function*. Ports are an attractive place for firms to settle into as a consequence of the large supply of raw materials and semi-manufactured articles.

Seen from the above perspective, a mainport can be considered as a turn-table between the global and the national/regional economic networks, through which voluminous flows of commodities and persons of strategic importance are being dispatched (see also de Wit and van Gent, 1986).

Given the strategic importance of mainports, many countries made it their objective to develop a mainport within their borders. This means that a mainport obviously has more to offer than merely its distributional functions. The actual function of a mainport (transhipment and transport) does not contribute much in terms of added value. The related logistic, industrial and services tend to be far more important. A mainport (and its related infrastructure) is therefore of real importance as a catalyst for generating the (indirect) investments in the industry and services sector (see Blaas et al., I99 I).

Another advantage of mainports is that they offer economies of scale. These economies of scale come into existence as a result of the geographic concentration of specific transport related functions (e.g. transhipment, storage, reparation and processing of materials). By this, an efficient distribution of enormous transport flows can be guaranteed from which transport efficiency gains come into existence. As a consequence of the scale economies of mainports,

the flows to the hinterland will become bigger thus leading to a better market position for the related, different transport modes.

2.2 The gateway concept

The concept of a gateway is not always unambiguous and sometimes it is not clear what is meant by the term gateway. According to Webster's Third New International Dictionary a gateway is:

"a passage for navigation or travel as
(1): any one of a limited number of points by which the traffic of a defined region can enter
(2): a point at which freight moving from one such region to another is interchanged."

it is sometimes claimed that modern gateways can no longer be considered only as points but as areas as well, e.g. internationally accessible host areas for direct investment. As a result, an enlarged definition of gateway activities is required. This definition may cover (Geabe and Schamp, 1994):

- new forms to organise the commodity flows and new forms to penetrate a hinterland
- new ways of entering a region or market with direct investment
- new flows attracted to the area at hand.

From the above mentioned views it can be derived that a gateway is an area that may cover regions of more than one country, through which the distribution of voluminous incoming and outgoing transport flows take place by means of transfer and transhipment, and in which added value can be obtained by entering new regions/markets with the help of direct investments.

Clearly, the gateway concept still creates confusion. It has even been suggested that the term should be replaced by a better, more specific and descriptive word. The gateway concept does not seem to be sufficiently multi-faceted enough to cover all aspects of bridging strategies which relate to gateways. On the other hand, the gateway concept is not specific enough to describe emerging dimensions of bridging strategies (Santalainen, 1995). Gateway strategies tend to bring economic benefits to firms, cities, regions or even countries. This is because public authorities can, for example, exploit the location, traffic and communication connections and infrastructure.

It should be added that timing plays a key role in developing successful gateway strategies. The correct timing of major strategic moves such as huge investments form critical success factors of a gateway strategy. It is thus important that gateway strategies are developed by the highest possible authorities such as the government or key ministries. In this context, gateways should in future public strategies be explored and addressed in greater detail than has been done in the past. One of these problems is, for example, the environmental and congestion burden of transit traffic, which causes increasingly high external costs which may reduce the economic benefits.

2.3 Accessibility and economic development

For establishing, maintaining and consolidating a mainport or gateway position, a high quality network of (international) connections is needed through which mainports and gateways are accessible. But what does accessibility in this context mean?

This concept contains elements which can be described as: the combination of speed, profitability and ease with which movements can be made (Adviesbureau Transpute, 1993).

This definition may be made more specific depending on the kind of accessibility to be considered. For mainports and gateways, it is also important that accessibility specifically measures how well a region, city or other geographical unit is connected to infrastructure networks. Accessibility cannot be derived from the quality of only one part of the infrastructure system. Systemic quality of the parts is brought about through a combination of (Adviesbureau Transpute, 1993):

- the quality of the functioning of the partial network on its own and
- the combination of the partial systems in the built environment and the social structure.

The success of mainports and gateways mainly depends on the quality and the quantity of the connections to the hinterland and to other transport modes and systems. Different specific transport systems are connected to other transport modes by mainports. The size and the position of origin and destination areas determine the connecting capacity of a transport junction. The greater the connecting capacity, the larger the diversity of destinations between which transport relations are possible, and the higher the chance to become a successful mainport.

The size of hinterland and the share in the transport flows to and from the hinterland shows the competitiveness of mainports and gateways. Because of this, distinct infrastructure projects need to be examined in relation to other infrastructure projects from a synergy viewpoint. From this perspective, the need for joining the European road network and for integrating rail connections with the European network is evident.

Presently, the accessibilii of mainports, gateways and their hinterland is not always at a sufficient level. These accessibility problems are mainly caused by road congestion in densely populated areas. improvements can be made especially in the field of freight transport by road. Examples of these improvements are: separate lanes for trucks, road exits owned by firms, the creation of more capacity for freight transport, and spreading out of transportation throughout the day and night.

Accessibility is important for mainports and gateways because there is a close relationship between accessibility, transport and economic development. Transport is very important for countries to be able to trade with other countries. Trade with other countries brings economic development. The capacity to create networks that tie regions to relevant external partners may become a stronger determinant for economic development than many other previously important internal factors. Those regions which have a sufficient level of accessibility and are successful in forging links, are likely to witness a significant increase in competitiveness and rapid economic development.

Accessibility of mainports and gateways is also important in creating opportunities for multi-modal transport. This kind of transport will also enhance economic development, because it will give rise to more efficient transport. The mainports and gateways must be sufficiently accessible for all modes of transport. A reason for this is that the distances over which commodities have to be transported are growing as a result of increasing internationalization. If longer distances become more common, attention will be given to other modes of transport. Firms want to transport commodities as cheaply as possible and, as a result, multi-modal transport will play an increasingly important role.

The points mentioned above once again emphasize that the accessibility of mainports and gateways needs to be of sufficient size and quality. For the use of multi-modal transport it can be added that connections to different kinds of infrastructure are also necessary to bring about economic development all over.

Finally, it should be noted that a mainport cannot be considered as self-contained. By means of its function as a turn-table, a mainport takes care of the development of different secondary and derived functions. As a result, a mainport can grow into a spatial concentration point for industry and employment. Because this is often related to the international transport

function, mainports offer important contributions to both the regional and international economy; the main contribution is growth in employment and in Gross Domestic Product (GDP).

3. MAINPORTS AND GATEWAYS IN A EUROPEAN CONTEXT

3. I Competition

The current emphasis on international competition is a fairly recent phenomenon. Thus far, traditional national arguments have played the main role in transport policies. But the process of economic restructuring requires a reconsideration of existing transport policies. This is because international competitiveness is the next important condition for enhancing the level of European economic performance after the completion of the internal market. Networks are vehicles through which nations can control part of the international competition.

The competitive position of regions is generally determined by the attractiveness of the region for (international) businesses. The choice of a firm for a certain region is based on the value the firm attaches to a package of locational factors: the quality of the working population, the price level of real estate, the qualii of infrastructure, the accessibility, and the position with regard to other economic centres in Europe. Therefore, it is important that mainports and gateways know their position in an international network. Mainports and gateways can only occupy a strong position in such a network, if they are adequately connected to other mainports and gateways.

Since the creation of the European Common Market, governments have been limited in the use of traditional policies for improving national competitiveness. This means that mainports and gateways are more entangled in a competitive battle to generate and attract knowledge-intensive industries in an international network society. Many of them appear to develop into powerful nodes in an international information network To maintain their position in this network, a first-class transport and communication system is vital.

Other important competitive factors for mainports and gateways are the following (Frybourg and Nijkamp, 1995):

* interconnectivity: the number of places that can be reached from a mainport or gateway
* intermodal flexibility: the number of transport modes that can be used to reach a mainport or gateway
* spatial-economic efficiency: the average cost to reach all other places
* geographical accessibility: the average time needed to reach all other places.

3.2 European policy

It is necessary but difficult to develop a general common European policy with regard to the European networks. Most countries still concentrate on their own interests. Apparently, a common European regional policy for mainports and gateways is a rather new phenomenon. The starting point for designing such a European policy is the concern about the possible impacts of a barrier-free Europe. The main objective of European economic integration is to enhance allocational efficiency to the economies of the member states by removing barriers to movement of goods, services and production factors.

The future of a unified Europe will be critically dependent on the functioning of strategic infrastructure networks which are interconnected in terms of integration between different layers of networks as well as intermodality between competing or complementary network modalities. Therefore, it is of great importance that the idea of Trans-European Networks is nowadays strongly supported by the European Commission:

The notion of interoperability of networks, as advocated in the Maastricht Treaty, generates a series of important issues which deserve thorough attention from the perspective of policy-makers and the research community (Nijkamp, 1994):

- the operation of transnational networks
- the close connection between the development of transport networks and (tele)communication networks
- the new roles of public and private decision-makers
- the interconnectivii of high speed long distance networks
- the role of physical barriers
- the emerging conflict between environmental sustainability, infrastructure expansion and competing networks
- the impact of new transportation on infrastructure life-cycles
- the lack of standardization of transport systems
- the lack of strategic insight into the linkage between European networks and global networks developed in other regions outside Europe.

Examples of various past imperfections in the European policy in the field of European networks have been:

- Transportation systems were developed in a segmented way. As a result of segmented planning, there are European failures but simultaneously national successes.
- There has been a lack of standardization. The greatest potential benefits for standardization can likely be found in rail transport.
- Inadequate attention has been given to multi-modal solutions. In looking for new network solutions a multi-modal view is essential.
- Too much attention is paid to new infrastructure instead of a more efficient use of existing networks.

We will now address more specifically the position of mainports and gateways from a European perspective.

3.3 The position of mainports and gateways in a European perspective

Almost all Western European countries have witnessed a considerable growth in transport demand, but investments in transport infrastructure have not grown to the same extent, therefore causing serious congestion problems. Because of current transport policies in Europe, it is plausible that the friction between growing mobility and current transport infrastructure will further increase. This is problematic because infrastructural factors, i.e. access to markets, customers or clients, and transport links with other cities and internationally, play an even more important role than cost arguments. So the quality of infrastructure is one of the most important factors in determining the qualitative position of mainports and gateways in European networks.

For mainports and gateways these considerations are important points. They have to take care of their accessibility and their competitive position within Europe. Mainports and gateways with a central position in Europe have a competitive advantage to mainports and gateways with a more peripheral position in Europe. Clearly, the Finnish gateways have a

peripheral position and the Dutch mainports are far more central within Europe. Until now, most attention has been given to the mainports and gateways in a central corridor between Milan and London, the so-called "blue banana". In this region, the most important regional-economic developments and the strongest economic interactions are supposed to take place. The geographical position of the Dutch mainports can be found in this corridor, but the position of the Finnish gateways is far outside this key corridor. We will now offer an assessment framework to judge mainport and gateway strategies in both countries.

4. THE USE OF THE PENTAGON PRISM FOR EVALUATING MAINPORTS AND GATEWAYS

4.1 The pentagon prism

A thorough comparative analysis of the mainports and gateways in the Netherlands and Finland is a somewhat thorny task, given the many differences between mainports and gateways, as well as between the two countries (for example economic, social and geographic). The most plausible approach then is to make a contrast analysis of the two countries. One way this can be done is with the help of the so-called pentagon prism (see Figure I). This prism outlines five types of success factors in which networks can be designed and developed. The five types of success factors are: hardware, software, orgware, finware and ecoware (Nijkamp, 1994). With the help of these success factors both countries will be compared with each other, in such a way that the factors may exhibit contrasting features.

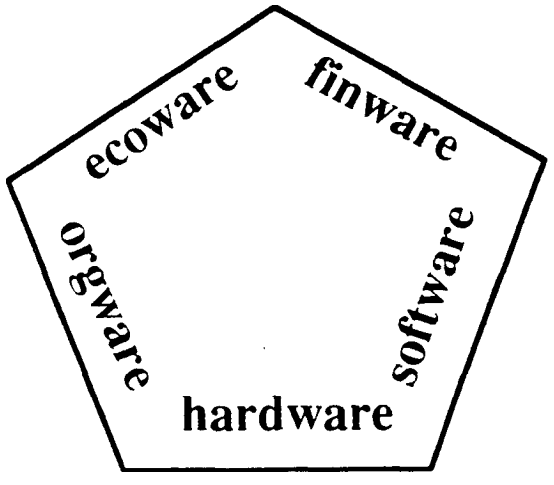

Figure I: Pentagon prism
(Maggi and Nijkamp, 1991)

First, we will give a short explanation of the five success factors in terms of mainports, gateways and freight transport.

Hardware

This element refers to the tangible material aspects of transportation infrastructure. The geographical position of the mainport and the connections with and the destinations in the hinterland also belong to the hardware.

Software

This factor refers to both computer software and the services offered to the user of infrastructure. The computer software is mainly used to control hardware facilities and focuses on the aspects of telematics. Services offered to the user serve to adjust the speed, safety, flexibility and reliability of transport systems.

Orgware

This factor has to do with all regulatory, administrative, legal, management and coordination activities and structures regarding both the demand and the supply side of transport. The government and industry management have to co-operate properly to satisfy the requirements of a modern mainport.

Fin ware

Finware mainly concerns financial aspects. These are not only the socioeconomic cost-benefit aspects of new investments, but they also include the ways of financing and maintaining new infrastructures for the benefit of freight transport and the accessibility of mainports.

Ecoware

This refers to environmental and ecological concerns in transport systems. Questions about energy and safety play a major role as well as user charge principles.

Many of the remarks above will have to be realised by the national government, whose task will be to remove bottlenecks which hamper the construction of roads, railways and hardware of harbours, but also includes regulation and the development of training programs. There is also the possibility to realise considerable parts of hardware, software and orgware with the help of industrial organizations.

On the basis of the principles of the pentagon prism, an analysis will be made of the different mainports and gateways in the Netherlands and Finland. The mainports are to be found in the Netherlands, while the gateways are located in Finland. The relevant mainports and gateways will be analyzed separately. In the final part of this section, the analysis will be briefly summarized in a qualitative table.

4.2 The pentagon prism used for mainports in the Netherlands

There are two dominant mainports in the Netherlands : Rotterdam harbour and Schiphol airport. Both are located in the so-called Randstad (a region of economic importance in the western part of the Netherlands). For this reason the entire Randstad, including the seaport and the airport, is sometimes also regarded as one Megaport. In this section however, the starting point will be the focus on two (separated) mainports.

First, we will discuss the critical success factors of the pentagon prism as they pertain to the analysis of the mainport function of Rotterdam harbour and the mainport function of Schiphol airport.

4.2.1 Rotterdam harbour

Rotterdam harbour is situated in the south-western part of the Netherlands (in the Randstad), near the North Sea. It is the biggest seaport in the world in terms of the amount of tons of goods; it is the biggest seaport of Europe concerning the transhipment of containers.

Hardware

The geographical position of Rotterdam harbour with regard to its diverse markets is favourable. For shippers, this is one of the most important conditions of a mainport. Rotterdam has a high score concerning accessibility, thanks to its central position in Europe. The neighbourhood of Schiphol airport is unique and may yield significant externality-based profits. The aggregate interests might be exploited by developing a market for combined sea-air freight transport, or by constructing a specific hinterland connection.

Presently, the share of hinterland connections via the rail in comparison with other harbours is underdeveloped. Meanwhile, this mode actually offers advantages in congestion and environmental problems (ecoware). The construction of the new freight railway line to Germany, the Betuwelijn, addresses these problems. The connections with the hinterland by water are excellent. The capacity of the inland navigation offers opportunities to replace road transport by water transport, especially for containers.

Software

Originally, Rotter-dam harbour had an at-rear on other European seaports regarding the customs system. With the pilot integration of the customs facilities, Rotterdam harbour has now reached and even superseded the level of the other harbours.

The quality of services is of a high level. An example of this is the start of a transport information system and the development of Teleport Rotterdam, which focuses on harbour related services.

The possibilities of using EDI (Electronic Data Interchange) are promising, but not yet fully exploited. The systems are present, but the user rate is rather low. A solution for this would be a better acquaintance with the system and an introduction of a standard for the various systems. The already existing systems are not sufficiently coordinated with other existing systems or systems in development. International standardization in this field would mean a great step forward.

Orgware

Rotterdam is specialized in transhipment, storage and treatment of all kinds of materials, as well as general cargo.

The appreciation of the shippers to the customs system is high, thanks to the presence of a customs free bonded warehouse. In the neighbourhood of the harbour, there are firms which are specialized in handling the incoming commodities before they are transported further.

There are numerous transport firms located in the harbour responsible for transport to the hinterland. Through these small scale firms, new developments in the field of logistics are sometimes hindered. Coordinating organizations are needed to lead this process in the right way for the entire maritime sector.

The same applies to the various modes. They also lack coordination or functioning of coordination. The lack of international standards has especially caused problems in rail transport and inland navigation with multimodal transport and containerization. The combined transport and the freight transport by rail will, in the short run, still be no alternative for road transport. In this contact, the government has to play an active role. Recently, the initiative arose to come to a joined integrated vision in co-operation with the province, the municipality, the government and industrial organizations.

Finware

The harbour dues in Rotterdam are relatively high in comparison to other European seaports. As long as there is a qualitativly higher level of services, this need not be a negative point.

There is a necessity for greater finances to build covered storage space as well as to enlarge the needed land use for firms. Infrastructure enlargements to the hinterland connections also

requires a huge amount of investments. Solutions might be found through joint financing between government and industrial organizations.

Ecoware

The main part of the transport of freight to the hinterland occurs by inland navigation. This form of transport does far less damage to the environment than other modes do. The share of road transport in the supply and distribution of commodities is nevertheless still significant. In view of the environmental problems, this trend must be curbed. Because of the growing pressure on regulating road transport from outside the government, environmentally friendty transport will become an important competitive factor for mainports.
(Blaas et al., I99 I)

4.2.2 Schiphol airport

Schiphol airport near Amsterdam is situated in the western part of the Netherlands, in the densely populated Randstad. Seen from an international point of view, the position of Schiphol airport is not more spectacular than the harbour of Rotterdam. The mainport function of Schiphol in a European perspective is however, rather strong and only superseded by London, Paris and Frankfurt in terms of international passenger flights.

Hardware

To act as a mainport, an airport must satisfy several hardware conditions regarding, for example, its infrastructure and number of flight connections. The most important point about flight connections is that they must connect sufficiently and frequently with hinterland places and major international destinations. The latter mostly depends on the airport's geographical position. Schiphol has a central position in Europe with the advantage of the neighbourhood of seaports. Schiphol also has line and network connections with other continents and a reasonable number of destinations with a high frequency.
The connection of the airport with roads and railroads is rather satisfactory. The supply and distribution of flows is hindered by the development of car mobility in the Randstad, Schiphol is well connected to the railroad network, but does not belong to the main junctions. The runways on Schiphol itself are not really favourably constructed. The tangential runway system forms a restriction on the capacity of the runways. A better constructed runway system would be able to cope with more flights. The capacity for passengers and freight storage is largely sufficient, although the design of the passenger terminal is not according to the latest developments anymore.

Software

The passenger and commodity flows as mentioned above, must be handled speedily and efficiently. To bring this about, a telematics infrastructure of sufficient size and quality must be in place. Examples of this at Schiphol airport are the electronical dispatch of the customs declarations and the quality of the air control tower operations. Integration of different automated systems is a problem once again due to the lack of standardization of the hardware and the type of software used. Other European countries are encountering the same problem. Investments in one standardized European system could be a solution.

Orgware

In the field of orgware, Schiphol has, as a determining factor for the competitive position, a megacarrier (KLM, which supplies more than 50% of all passengers), and one of the most important charter companies in the world (Martinair). Schiphol has an all-round position in the transport market. One special and strong point of Schiphol is the "one terminal concept". The total dispatch of passengers takes place in one terminal and minimizes the time needed for

transfers. The services regarding the passenger facilities are judged well, and regarding the freight facilities they are even judged excellent. An advantage of the airport is the high quality of the Dutch transport and distribution sector. The market position of Schiphol is very good in the European, North American and Far Eastern area for both passengers and freight. The management of Schiphol responds well to developments and changes in the market position. There is however a need for a more sophisticated financial, congress, tourism and high-tech centre in the neighbourhood. With respect to the biggest competitors, the home market is relatively small and Schiphol has a hard job to get customers.

Finware

The landing fees as well as the air fares ensure a competitive position of Schiphol. Furthermore, the prices of the surrounding land and real-estate in the region of Amsterdam are lower than the prices of its biggest European competitors. Nevertheless, it is a disadvantage that no real international financial centreexists in the neighbourhood.

Ecoware

Schiphol is, like other European airports, faced with many environmental problems. The extent to which Schiphol damages the environment is high at this moment. This may also harm the willingness of firms to settle down in the area (Blaas et al., 1991).

4.3 The pentagon prism used for gateways in Finland

Finland has an entirely different position than the Netherlands. This is because there are no typical places which can be identified as mainports. Due to its geographic position, Finland has only areas which generally function as gateways through which commodity flows are transported. One of the opportunities in which Finland can function as a gateway is to build up a position as an international transport centre. The most important areas functioning as a gateway are the Barents Region and the Baltic Region.

In this subsection, the critical success factors of the pentagon prism will be analyzed for the gateway function of the Barents Region and the Baltic Region.

4.3.1 The Barents Region

To gain an impression of the Barents Region, a general description will first be given. After that, the specific factors of the pentagon prism will be described.

The Barents Euro-Arctic Council was established in January 1993, as a forum for co-operation between the states in the area at the national, regional and local levels. According to the conception of the Council, co-operation should contribute to peace and stability, sustainable development and prosperity in the area. and in Europe as a whole (Finnish Barents Group Oy, 1995). The wish to create a Barents Region is, to a large extent, a question of demand for regional visibility in Europe. It is not yet functioning as a real gateway, but the countries involved are busy working out the initiatives. Nevertheless, the Barents Region is becoming more a part of the growth-oriented world economy, mostly because of its rich natural resources. One thing that must be kept in mind in building up policy strategies is the fact that there are major differences between the countries of which the Barents Region is a part.

Hardware

The Barents Region represents a particularly suitable location for international transportation. It is near the Scandinavian countries and central Russia; it has the ice-free harbour of Murmansk, and the possibility of utilising the North-East passage. The transportation system in the Russian section of the Barents Region cannot reasonably be compared with the

neighbouring countries of Finland, Sweden and Norway. The railway is the primary form of transportation for passengers and goods, complemented by river boats and harbour vessels. Airlines only take on a part of the long-distance transportation. The road system of northern Russia is poorly developed. Most roads run in a North-South direction and some areas have no road network whatsoever. The improvement of the international road connections from Murmansk to the Nordic countries is given high priority in the region. This became even more crucial after Finland and Sweden joined the European Union and the Finland border became Russia's only border with Europe. One of the advantages of joining the European Union is that only one set of customs formalities is required to and from all EU countries.
The most important waterways of the Region are the Arctic Sea routes and the coastal water roads of the Barents Sea and the White Sea. The importance of such northern ports has grown since the dissolution of the former Soviet Union and the loss of some of the ports in the Baltic countries and the Black Sea.
One of the most important aspects of the Barents Region is its natural resources. The Barents Region is extremely rich with fish, forest, minerals, coal, peat, hydropower and, especially, oil and gas (Finnish Barents Group Oy, 1995).
These resources will form the basis for future economic development in the region. The main markets of the industrial products are in several parts of Europe. There is a need then, for greater international co-operation between the regional organizations and those outside the Barents Region.

Software

The Barents Region is definitely not at the level of Western Europe with regard to the software. For example, the telecommunication system in the Russian Federation is still rather underdeveloped compared to the Western systems.
The communication is mainly intra-national and flows in the north-south direction are favoured. This is the result of years of strong barriers between east and west; barriers with a natural geographic, structural, administrative and cultural character. One of the things most needed is a telecommunication network within the area and with other areas (Dellenbrant and Olsson, 1994). Probably the most difficult task in developing these networks will be to connect the new equipment with existing telephone exchanges (Finnish Barents Group Oy, 1995).

Orgware

Both within the Nordic countries and between the Nordic countries and Russia, the transport systems do not have sufficient connections. The internal Nordic trade still meets barriers in the form of different national regulations. The physical transportation capacity is there, but the potential cross-border utilization is blocked by incongruencies in support, permits, and border passing rules.
Land, sea, air, and rail transport is poorly connected, thus resulting in low exploitation of capacity and low cost effectiveness. The national authorities' rules and plans for development and investments are not designed for the region as a coherent area, but are based on the concept that they shall serve the infrastructures of four different countries. Due to the exceptionally long freight distances on land, better coordination of the authorities' steering and investment efforts should have a great potential for cost reduction.
When Finland and Sweden joined the European Union at the beginning of 1995, the Barents co-operation acquired a new momentum. The common land border between the European Union and Russia and the EU's increasing interest in supporting the economic development of northern regions will make the EU a major player in the Barents co-operation. Therefore, the influence of EU directives and other EU legislation on non-EU regions has to be taken into consideration in the future development of trade and economic co-operation.

Finware

Enormous numbers of investments are needed before the Barents Region can be competitive. Therefore, new networks between Russia and the Nordic countries are needed. Investments in these networks should be based on an analysis of prospective flows with their benefits and costs. A major challenge will be the financing of the investments needed for new infrastructure links and networks, the development of airline and telecommunication systems, nodes, city systems, detailed logistic connections and services. But investments in the transportation sector should be guided along with investments in industrial and environmental programs. There is currently a serious lack of financing.

For European countries, investments in the Finnish part of the area are most interesting if they are interested in doing business with neighbouring areas.

Ecoware

Extensive industrial activities combined with out-of-date production technology of the factories have caused severe pollution and environmental damage in some parts of the Barents Region. There is a need for large-scale investments to reconstruct and modernize the mining and wood processing industries in particular. Further exploitation of these resources needs to be carried out according to the principle of sustainable development.

4.3.2 The Baltic Region

A council for the Baltic Region was established in March 1992. The foreign ministers of the different countries signed the agreement. The goal of the council is to promote and support further co-operation across the Baltic Sea. Special areas of policy interest are: economics, traffic, the environment, development of infrastructure and issues related to the development of democracy in the former Eastern Europe.

The Baltic Region consists of the Nordic countries (minus Iceland), Russia, the Baltic States, Poland and Germany. In this definition the Baltic Region comprises a huge area (Platz, 1994). Another definition of the Baltic Region (a narrow one) is the area made up by Denmark, Sweden, Finland, the Baltic States, the areas of St. Petersburg and Kalingrad, those of Mecklenburg-Vorpommem (the northern part of the former East Germany) and Schleswig-Holstein (the northern part of the former West Germany), and the vojvoidships of Szczecin, Kozalin, Slupsk, Gdansk, Elbag, Ostyn and Suwalki in Poland. This area has a total population of 35 million inhabitants (Storm Pedersen, 1993). A difficulty in analyzing the Baltic Region according to the pentagon prism is caused by the vast differences within the region. For example, the western part has a well-developed infrastructure and a clear organization, while the eastern part still suffers from a lack of infrastructure and is barely organized. We will now describe in more detail the five factors of the pentagon prism.

Hardware

For the Baltic Region, the backbone of its international transportation system is the Baltic Sea. Sea transport has a high flexibility and networks can be built up more quickly than other means of transport. A large number of ports can be found around the Baltic Sea allowing land transport distances to be kept short, particularly in foreign trade. A large number of cities with a tremendous economic power are located along the coastline of the Baltic Sea (among them are five capitals) (Storm Pedersen, 1993). The Baltic Sea is crossed by a large number of ferryboat lines for passengers and road vehicles. Some of them also carry railway wagons. Many ports with significant overseas liner traffic can be found in the different countries. The quality of hinterland transport links is good for most Nordic and Western ports and is especially important when trying to promote sea instead of land transport.

Better connections with northern and western Europe need to be developed, as transport growth is the highest here. The main cities of European or Baltic importance are linked to the

international railways network, but the overall quality of the railway services is insufficient in the majority of the transition countries. The capacity of the railway networks needs to be extended to other countries. improved links between urban centres and rural hinterlands are required to allow all subregions to participate in the development process.
The international road traffic has, for the time being, to rely on a road system of a regional nature and design standard. Travel times on national railways and roads are not yet adequate to promote the qualities of secondary urban centres.

Software

The eastern part of the Baltic Region is not up to the level of Western Europe with regard to the software. Regional centres in Central and Eastern Europe are not adequatefy linked to national and international centres. This leads to a rapid decline of the competitiveness of such centres in becoming major players in international gateway developments.
Telecommunication can play an important role in striving towards a more sustainable spatial structure. Mobile phone networks can be a most rapid means of improving telecommunication, but the spatial coverage is insuffiient at this moment.

Orgware

After the founding of the Baltic Sea Council, the necessary condition to create an organized system was fulfilled. But the Council has been rather ineffective, at least among the Scandinavian countries. There have been no strong interests in developing the council into an influential organization for regional co-operation. Nevertheless, the structure for co-operation exists and it may promote transactions across the Baltic Sea. Urging for co-operation makes it easier to enhance the development of networks. Finland has free trade agreements with the Baltic Countries. Because of the transit traffic, the sea ports on the Gulf of Finland have a particular interest in exploiting the East-West Gateway concept. Many countries border the Baltic Region; there is an approximate 4500 km borderline. Cross-border linkages offer interesting potentials to overcome economic restrictions. Cross-border cooperation initiatives exist in the Baltic Region at every level: municipal, regional and national. During the first half of the 1990s, Finnish businessmen have rapidly founded enterprises in the Russian border regions, thus opening a gate to the West. The improved circumstances considerably increased cross-border co-operation and business activities between Finland and Russia in the early 1990s.

Finware

Finland is the most northern and eastern region among the Nordic countries and, because of its location, has a sincere interest in new ferry routes and road links to central and southern Europe via the Baltic Sea or via land on the eastern side of the Baltic Sea. Seen in a Northern European context, the region forms an enormous potential market for investment in business, infrastructure and the environment. Investments motivated by transport demand and investments aiming to reach and enhance future demand are required. Otherwise, the differences in interaction and integration potential between eastern and western Europe will widen. The EU has shown considerable interest in providing the missing links in the European transport network. This has brought the Western Baltic into focus because at least three missing links are to be found in this region.

Ecoware

In the vision 20 IO for the Baltic Region there are many initiatives for facilitating environmentally friendly transport. Firstly, the infrastructure network will be linked to the devised urban network to promote environmentally friendly sea and railway transport. Second, combined transport and intermodal co-operation will be enhanced in order to

promote sea conveyance instead of land transport, and the railway instead of road transpon wherever feasible. And third, care will be taken so that new major infrastructure projects minimize their negative effects upon the environment. But despite these initiatives, road traffic is increasing rapidly and rail transport loses its competitiveness due to poor service standards and low speed.

4.4 Qualitative summary of the pentagon prism analysis

The preceding analysis of the Dutch and Finnish mainports and gateways is quite comprehensive. To synthesize the given information, a qualitative survey table is constructed. The most important qualitative aspects concerning the five pentagon factors are listed for each of the four mainports and gateways distinguished. From this table it can be inferred that the qualitative differences between the mainports and gateways are not as great as one would first have imagined.

The terms used in this table pertain to the current situation in the regions discussed. For example, the term "great potential" listed under the hardware of Gateway 2, does not equal the level of impact if the same term were used for one of the mainports. This table just makes it easier to interpret the results of the analysis, if further analytical steps have to be taken.

Orgware	Hardware	Software		Finware	Ecoware
Mainpott I (Rotterdam harbour)	favourable	high level and still growing	lack of coordination and standardization	joint financing	proper use of inland navigation
Mainport 2 (Schiphol airport)	reasonable	high level, integration needed	very good market position, high quality of transport and distribution sector	great advantage concerning price level	environmental burden far too high
Gateway I (The Barents Region)	peripheral, lack of infrastructure connections	underdweloped	cross-border problems	huge number of investments required to build new networks	severe pollution and environmental damage
Gateway 2 (The Baltic Region)	great potential	underdeveloped	co-operation advantages	EU interest in eliminating missing links	initiatives to facilitate environmentally friendly transport

Table I: Qualitative results of the analysis

It will now be interesting to compare the four situations decribed above on the basis of the multidimensional set of pentagon factors in order to identify contrasts between mainports and gateways in two diffent countries. In the next chapter, Multi-Criteria Analysis will be used to analyze the Dutch and Finnish mainports and gateways, and to find out their relative attractiveness and future potential.

5. A MULTI-CRITERIA ANALYSIS FOR THE EVALUATION OF MAINPORTS AND GATEWAYS

5.1 Introduction to Multi-Criteria Analysis

Multi-Criteria Analysis (MCA) has become one of the most effective methodologies in multidimensional optimization analysis. It serves to improve decision-making by providing both a methodological platform for decision analysis and an operational framework for actual decision-making. The major feature of MCA is that it addresses evaluation and choice problems marked by various conflicting interests. The main aim of this analysis is to provide information on the nature of these conflicts so as to make the trade-offs in a complex choice situation more transparent to a decision-maker or policy agency.

Impact analysis is an important first step in evaluation research, but so is the assignment of weights reflecting the (relative) importance of the various impacts envisaged. The use of weights, which reflect the relative importance of the objectives or criteria in question, are a very common way of explicitly dealing with priorities in evaluation approaches (Nijkamp et al., 1990).

There are various classifications of multi-dimensional evaluation methods which can be used in practice. The most important classification of methods is that of the discrete multi-criteria methods versus continuous multiple objective methods. Discrete methods only display a finite number of feasible choice possibilities in, for example, courses of action, strategies and solutions. Continuous methods, on the other hand, display an infinite number of choice possibilities.

In this paper the Regime Analysis will be used for the analysis. This is a method belonging to the class of discrete multi-criteria methods; it can to some extent be interpreted as an ordinal generalization of pairwise comparison methods.
Its starting point is an ordinal evaluation matrix and an ordinal weight vector (see for details Nijkamp et al., 1990).

5.2 Application of Multi-Criteria Analysis to Dutch mainports and Finnish gateways

The main aim of discrete multi-criteria methods is to provide a basis for classifying a number of alternative choice possibilities on the basis of multiple criteria. These kinds of methods often use two kinds of input data, namely an evaluation matrix and a set of political weights attached to the criterion scores included in the evaluation matrix.
Firstly, it is important to determine which are the alternatives and which are the criteria in the analysis of a certain evaluation case.
In the case of the Dutch mainports and the Finnish gateways, the alternatives and the criteria are taken to be the following:

Alternatives: Mainport 1, Mainport 2, Gateway 1, Gateway 2
Criteria: Hardware, Software, Orgware, Finware, Ecoware

The next step is to determine the data which have to be incorporated in the matrix. The required data for this matrix emerge from the analysis of the Dutch mainports and the Finnish gateways presented in section 4 (see also the qualitative table in subsection 4.4). In this table, a "higher" score represents a "better" performance.
The result is the following:

	Hardware	software	Orgware	Finware	Ecoware
Mainport I	8	8	7	8	8
Mainport 2	7	8	8	8	5
Gateway I	6	7	7	7	6
Gateway 2	8	7	8	8	7

Table 2: Criterion scores of pentagon factors

Next, we have undertaken an evaluation of the future potential of the four alternatives by using different weight schemes for the five pentagon criteria. With the help of a computer software model for the Regime Analysis, the relative attractiveness or future potential of the four alternatives can be shown. An example is given in the matrix below, where only an unweighted result is presented.

	Performance score
Mainport I	0.890
Gateway 2	0.665
Mainport 2	0.442
Gateway I	0.003

Table 3: Relative attractiveness of the four alternatives in case of unweighted pentagon criteria

In this matrix, Mainport I is apparently the most attractive and promising of the alternatives, but in this stage of the analysis no weights have yet been given to the criteria in the evaluation matrix.

The next step is then to use different sets of weights attached to the criterion scores in the evaluation matrix. In our case of the five critical success factors of the pentagon prism the criteria in the analysis, one has to specify the relative importance of the criteria concerned. The selection of weights is certainly a political matter: the importance of each criterion (i.e. critical success factor) depends on political choices. For example, one may assume that wealthy societies may concentrate more on the requirements of the ecoware criterion than poor societies can. But changes in the hardware, for example, can influence the ecoware, if one considers particular types of hardware. In this case then, hardware would be important, whereas ecoware would be less so. The second important criterion is the orgware. This is because the attractiveness of mainports and gateways depends mainly on regulations, procedures, fares and legislation. Another reason is that current trends suggest more attention on market incentives 'for improving the competitive position vis à vis other countries, while reasons for government intervention have become less valid. The next important criterion, software of the mainports and gateways, seems to be of more importance than the finware, because the user of the infrastructure is highly dependent on the services offered. The most important aspects of finware are the construction of new infrastructure for the benefit of freight transport and accessibility, which would be a result of the criteria mentioned above. As previously mentioned, the ecoware would, in this case, be the least important criterion.

The weight set with regard to the five critical success factors of the pentagon prism would under such conditions be the following:

$$weight_{hardware} > weight_{orgware} > weight_{software} > weight_{finware} > weight_{ecoware}$$

If these rank-order weights are given to the criteria in the evaluation matrix, the application of the Regime Analysis results then in the following performance scores for the four strategic options:

	Performance scores
Gateway 2	0.834
Mainport I	0.832
Mainport 2	0.333
Gateway I	0.000

Table 4: Relative attractiveness with weights given to the pentagon criteria

This ranking shows that differences do show up, if weights are given to the pentagon criteria. Mainport I is then no longer number one and Gateway 2 is in first position. A closer look at the tanking results, however, gives the impression that there is no longer a real first position. The differences between the results of Gateway 2 and Mainport I are so marginal that they may be considered as having equal attractiveness. However, the differences with the other two alternatives are more significant. If another order of relative importance is given to the criteria, it is possible that the matrix will show a different order of attractiveness of the mainports and gateways.

In any case, the results of this analysis show that it would be recommendable to pay more attention to “peripheral” northern gateways. They could play a more important role in the movement towards unification in Europe than they fulfil until now. A stimulus for these regions could be a separate policy for such areas in stead of only one policy for "mainports which act like gateways”.

6. CONCLUDING REMARKS

The movement towards unification of Europe, as well as the reduced efficiency of traditional national policy instruments, have led to an increasing attention for transport infrastructure in Europe. It is important that not only the “hardware” and “software” are considered as direct and clear success factors, but that "orgware", “finware” and to lesser extent “ecoware” are also taken into account. It should be acknowledged that the latter three factors are of critical importance for the economic structure as well as the welfare and well-being of countries and regions.

Another significant factor in the unification of Europe, co-operation, played an important role in the analysis of the Dutch and Finnish cases based on the pentagon prism. Co-operation appears to manifest itself in different contexts: co-operation between the government and the parties concerned regarding the Dutch mainports, as well as co-operation between the different member states of the gateway Councils in Finland. In case of the first type of co-operation one may think of the need for increasing the co-operation between the national government and industrial organizations which have an interest in Dutch mainports, in order to fulfil the requirements of a modem mainport (for example, in the field of infrastructure and the stimulation of technological applications). This type of co-operation includes co-operation in the field of financing infrastructure. The trend now is to switch from government financing to private or joint financing of infrastructure.

The second type of co-operation that became apparent in our analysis, is between member states of the gateway Councils. In the Baltic Sea Council and the Barents Euro-Arctic Council, there is co-operation within a region which is partly in the European Union and partly beyond its borders. This kind of co-operation makes it possible for the EU to connect, if not directly integrate, some of the former socialist countries into the Union and, more generally, into the West European structures. This form of integration does not bind the European Union or the EU countries into heavy investments in the economies of the less developed countries which would be the case with a full membership.

There is an assumption that in both areas, regionalization increases the value of these regions by connecting the peripheries to the centre, and hopefully also strengthens them vis à vis the traditional economic and political core of Europe. Therefore, one may argue that the aim of regionaliition on the northern axis is at least to avoid further peripheralization. In addition, in both regions the European Union stretches beyond its eastern border and connects Russia into western European regional structures and processes.

For example, the name Barents Euro-Arctic Region suggests a link to processes of integration and co-operation of a more integrative nature in Europe. It indicates a "Europeanization" of the co-operation but leaves out the question of formal membership in the European Union. As a loose concept,- "Europeanization" is used here to indicate that regional co-operation is connected to Central European integration processes.

These two forms of co-operation show that there are fundamental differences between the mainports in the Netherlands and the gateways in Finland. It is very difficult to compare them with each other by using the same standards. The analysis can be made only if it is assumed that not all the criteria need to have the same numerical meaning during the analytical process.

By examining the results of the Regime Analysis, the first m matrix shows that the relative distance between the four alternatives is spread in a fairly balanced way, with the Dutch mainport "Rotterdam harbour" in the first position. After giving weights to the criteria, it is striking that "Rotterdam harbour" shares its first position with the Finnish gateway "the Baltic Region" (ii actually loses its first position), whereas the differences with the other two alternatives are enlarged.

From these results it can be derived that perhaps policy makers do not yet pay enough attention to "peripheral" northern gateways. Until now, most attention has been given to the regions in the east-west corridor between Milan and London, the so called "blue banana". In this region, the most important regional-economic developments and the strongest economic interactions take place. The results show however, that the northern gateways could play a more interesting role in the unification process of Europe, particularly since they are in the neighbourhood, or even part of the only border area between the European Union and Russia. Developments in this direction however, bring about increasingly competitive battles between different countries trying to obtain a mainport or gateway position. The critical success factors of the pentagon prism can play the determining role in these conflicts.

A Multi-Criteria approach may be a helpful method to stimulate and structure discussions on these issues. In contrast to less systematic planning approaches, explicit attention is given to all dimensions of the problem due to the use of qualitative (and often quantitative) criteria and alternative weighting schemes.

An example can be given for the "hardware" factor; the flows of freight transport in the northern countries are still far below the size of the freight transport flows in the Netherlands. improving the infrastructure networks in those countries which connect Finland with the hinterland, would be fundamental in reaching a higher level of freight transport flows in Finland, and also in obtaining a stronger position as a transit country in the European economy. An active role of the government and maybe possible private investors is required in this process.

As mentioned earlier, there are fundamental differences between mainports and gateways, but in most of the literature, no distinction is made between the two concepts. It seems that even in policy-making, there is only one policy for "mainports which act like gateways". To give gateways such as the Barents Region and the Baltic Region a chance, it is necessary that a separate policy be developed for these areas to achieve a more distinct profile.

Advantages of a separate policy for gateways are that more attention be given to the own central issues; it gives opportunities to specialize in certain fields and it will ensure more acquaintance with the concept of gateways, which makes it easier to opt for a stronger position within Europe.

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